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## Brief Report

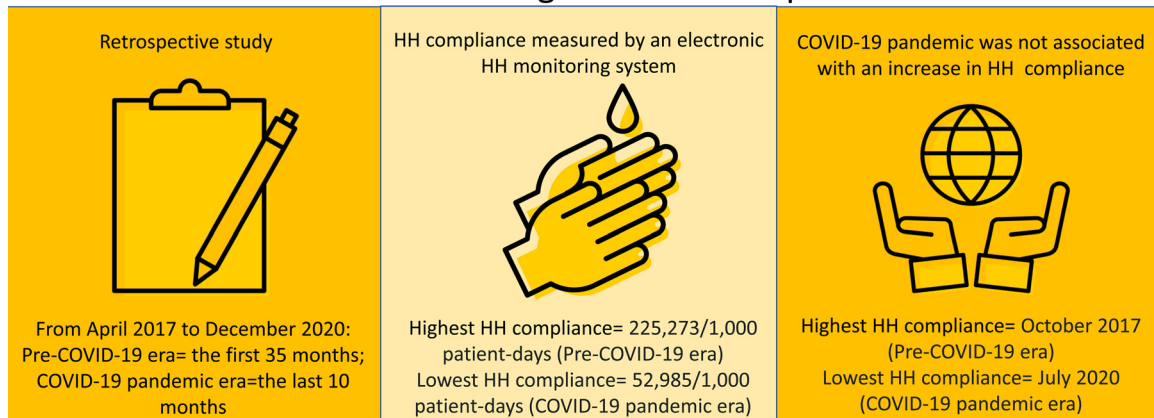
## Hand hygiene performance in an intensive care unit before and during the COVID-19 pandemic



Eduardo Casaroto MD<sup>a</sup>, Jose Roberto Generoso MD<sup>a</sup>, Bruna Marques Tofaneto<sup>b</sup>, Luigi Makowski Bariani<sup>b</sup>, Mariana de Amorim Auler<sup>b</sup>, Nathalia Xavier<sup>c</sup>, Marcelo Prado PhD<sup>d</sup>, Elivane da Silva Victor MSc<sup>a</sup>, Takaaki Kobayashi MD<sup>e</sup>, Michael B. Edmond MD, MPH, MPA<sup>f</sup>, Fernando Gatti de Menezes MD<sup>g</sup>, Alexandre R. Marra MD<sup>a,e,\*</sup>

<sup>a</sup> Instituto Israelita de Ensino e Pesquisa Albert Einstein, Hospital Israelita Albert Einstein, São Paulo, Brazil<sup>b</sup> Albert Einstein Medical College, São Paulo, Brazil<sup>c</sup> Albert Einstein Nursing College, São Paulo, Brazil<sup>d</sup> Division of Research and Development, i-HealthSys, São Carlos, Brazil<sup>e</sup> Department of Internal Medicine, University of Iowa Carver College of Medicine, Iowa City, IA, USA<sup>f</sup> West Virginia University School of Medicine, Morgantown, WV, USA<sup>g</sup> Infection Control Unit, Hospital Israelita Albert Einstein, São Paulo, Brazil

## Hand hygiene (HH) performance in an intensive care unit before and during the COVID-19 pandemic



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Hand hygiene

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## A B S T R A C T

The current COVID-19 pandemic has heightened the focus on infection prevention in hospitals. We evaluated hand hygiene compliance with alcohol-based hand rub via electronic observation among healthcare workers in an intensive care unit from 2017 to 2020. The COVID-19 pandemic was not associated with an increase in hand hygiene compliance.

\* Address correspondence to Alexandre R. Marra, MD, University of Iowa Hospitals and Clinics, C51 GH, 200 Hawkins Drive, Iowa City, IA 52242.

E-mail address: [alexandre-rodriguesmarra@uiowa.edu](mailto:alexandre-rodriguesmarra@uiowa.edu) (A.R. Marra).

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Sanitizing Opportunities in Hospital Wards” US Patent Number 9,679,464 B2, issued on June 13th, 2017 (<https://patentimages.storage.googleapis.com/b3/a4/db/8413c20473b734/US9679464.pdf>).

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## BACKGROUND

Hand hygiene is an important measure for the safety of healthcare workers (HCWs) and patients<sup>1</sup> and monitoring the hand hygiene adherence and providing feedback to HCWs is recommended by the Centers for Disease Control and Prevention.<sup>2</sup>

Electronic hand hygiene monitoring via alcohol dispensers with radio frequency identification (RFID) is a useful tool for collecting accurate data of hand hygiene compliance by HCWs and providing feedback.<sup>3,4</sup> Feedback loops are profoundly effective in changing human behavior<sup>4</sup> by giving people information about their actions in near real-time then showing them how to transform these actions into better behavior.<sup>4,5</sup>

The current COVID-19 pandemic has made hand hygiene the focus of attention. However, limited data is available on how hand hygiene compliance has changed during this pandemic. We aimed to evaluate if hand hygiene compliance improved during the COVID-19 pandemic using an electronic hand hygiene monitoring system with RFID installed in intensive care unit (ICU).

## METHODS

This study was conducted in an ICU of a private tertiary care hospital, Hospital Israelita Albert Einstein, in São Paulo, Brazil. This ICU is an open staffing model medical-surgical unit with 40 beds. Four beds were randomly selected for the study intervention.

We retrospectively investigated hand hygiene compliance measured by an electronic hand hygiene monitoring system (Infectrack).<sup>5</sup> The study was conducted for 45 months (from April 2017 to December 2020). The first 35 months were considered the pre-COVID era and the latter 10 months were considered the COVID-19 pandemic era.

Data on hand hygiene events were recorded by an electronic hand hygiene monitoring system attached to alcohol dispensers. The electronic monitoring system counts each activation of the alcohol gel dispenser and there were 2 dispensers in each room and 1 between each room.

Real-time feedback technology using ZigBee (iHealthSys, São Carlos, São Paulo, Brazil, wireless communication protocol based on IEEE 802.15.3 standards) has been used in our hospital (though not in the study unit) since June 2013.<sup>5</sup> ZigBee uses a wireless identification badge worn by HCWs to sense when an HCW performs alcohol hand

rub using an alcohol dispenser. A red-light flash above the patient bed when an HCW approaches the patient without performing alcohol hand rub. The bedside sensor light turns green if the HCW performed hand hygiene. Therefore, HCW receives real-time feedback through this technology.

We investigated hand hygiene events per 1,000 patient-days each month throughout the study period. Descriptive statistics were computed. An ARIMA regression model was used to evaluate the difference in hand hygiene rates between the pre-COVID-19 era and the COVID-19 pandemic era. Statistical analysis was performed using R and Forecast. All reported tests were 2-sided and *P* values <.05 were considered significant. This study was approved by the hospital's Institutional Review Board.

## RESULTS

During the pre-COVID-19 era, monthly hand hygiene rates significantly decreased from 225,273 to 52,985 per 1,000 patient-days (effect= -953.5; *P* = .047; 95%CI: -1893.0 to -13.9, Fig 1). During the pandemic era, hand hygiene rates increased, however, it was not statistically significant (effect= 781.5; *P* = .738; 95%CI: -3799.1 to 5362.1). The highest monthly compliance was observed during the pre-COVID-19 era (October 2017) and the lowest compliance was observed during the pandemic era (July 2020).

## DISCUSSION

This study investigated hand hygiene compliance by HCWs using an electronic hand hygiene monitoring system in an ICU over a 45-month period. The COVID-19 pandemic was not associated with an increase in hand hygiene compliance.

During the COVID-19 pandemic, several guidelines have addressed the importance of hand hygiene.<sup>2,6,7</sup> However, this study showed that hand hygiene compliance in the ICU did not improve significantly, and it remained relatively low through the end of the study period. Other studies using automated hand hygiene monitoring systems showed a slight increase in hand hygiene compliance at the beginning of the pandemic followed by a decrease.<sup>6,7</sup> We hypothesize that a substantial increase in the workload during the COVID-19 pandemic might have negatively affected the quality of hand hygiene.<sup>8</sup> This low adherence might have been associated with

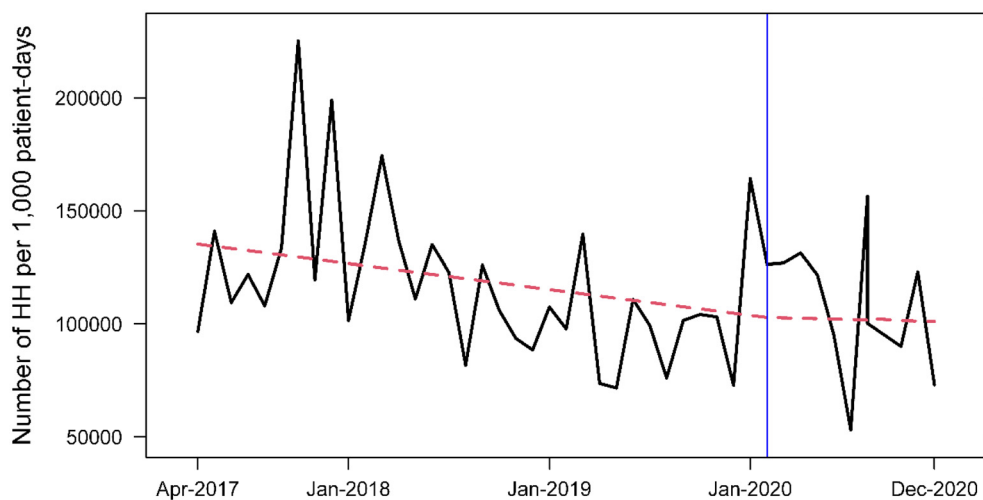


Fig 1. Hand hygiene events per 1,000 patient-days in an ICU, April 2017 to December 2020.

inadequate training for taking care of COVID-19 infected patients and/or increased mental health issues among HCWs due to a critical situation in Brazil early in the pandemic.<sup>8,9</sup> Not only the COVID-19 pandemic but the emergence of other infectious diseases including Zika and dengue infection have been burdening the Brazilian health-care system.<sup>10</sup> The inappropriate use of gloves in contact precautions throughout the COVID-19 pandemic (data not shown) could have also contributed to the non-increase in adherence to hand hygiene.

In general, hand hygiene compliance is measured by direct observation and there have been a paucity of large studies assessing hand hygiene using an electronic hand hygiene monitoring system, especially during the COVID-19 pandemic.<sup>3-5</sup> Using an automated electronic system can be more accurate for evaluating hand hygiene than direct observation.<sup>3,5</sup> In addition, studies that employ small samples of hand hygiene opportunities by direct observation are likely to be biased by the “Hawthorne effect” (the effect of the observer on an observed person influences compliance).<sup>1,3</sup> Current evidence supports electronic hand hygiene monitoring systems as a method to supplement but not supplant direct observation, since current systems are not able to evaluate the quality of each hand hygiene episode that HCWs perform, nor do they typically allow for immediate peer-to-peer correction at the point of care.<sup>1,3,5</sup>

There are several limitations. This study is a retrospective, single-center study performed in a limited number of ICU beds. This new technology has not been implemented to non-ICU beds yet due to cost and necessary infrastructure. The real-time feedback technology could cause fatigue among HCWs with too much feedback per shift. The strength of this study is that we included 35-month data of hand hygiene during the pre-COVID-19 era, giving a global vision of the impact of COVID-19 on hand hygiene compliance.

In conclusion, we demonstrated that an electronic hand hygiene monitoring system could help us trend hand hygiene performance in an ICU setting. More prospective studies are needed to better understand the impact of COVID-19 on hand hygiene compliance.

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